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Lesson Plans

CMST Institute

10-29-2004

Estimating Population Size

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The College at Brockport

CMST SCOLLARCITY Lesson Plan Template-Lesson Plan using **TI Technologies** (Due Tuesday, July 27th)

Submit as hard copy AND electronically through ANGEL

Name: Kristin Schwartzmeyer
Grade level(s)/Subject taught:7th grade Science
Objectives: (Remember…*How will the modeling tool help the student better learn the objective?) Estimating population size. Student's will gain an understanding of how biologists working in the field obtain data; analyze that data; and present data.*

Items to include in your TI Technologies lesson plan: (use *your* area/discipline/concepts).

For the math teacher:

1. *Write* the Mathematical Concept or "key idea" that TI Technologies will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

The math concept will concern extrapolating population size using a sampling technique. Students will use an equation to solve the question presented, along with graphing a linear regression line, to predict future population size.

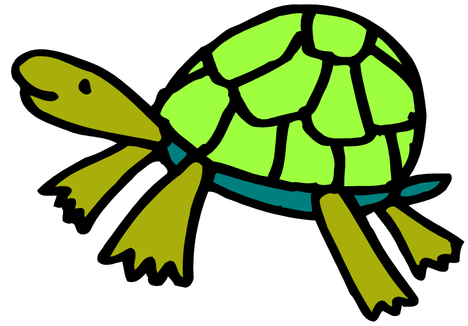
and/or…

For the Science teacher:

1b. *Write* the Science Concept or "key idea" that TI Technologies will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

The science concept is population estimation. In order for students to examine population genetics it is first important that students understand how data is obtained in the real world by real scientists.

Student Lab: Turning Turtle



Student name ________________________________

Purpose:
In this lab we will simulate a mark and recapture technique for estimating population size. Students will be given model paper turtles; a “pond”; and calculator.

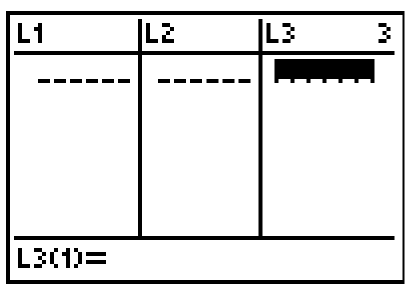
Materials:
A box or paper bag to represent a pond
Model paper turtle population
Graphing calculator
Student Lab

Procedure:

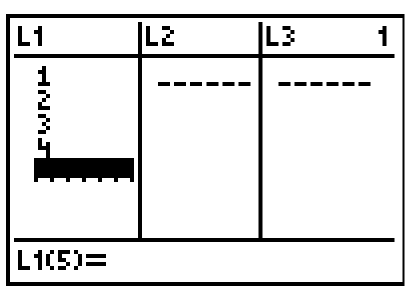
1) The data table below shows the results from the first three years of the study.
2) You will be given a box which represents your study pond. 15 turtles have been marked, as shown in the data table for year 4.
3) Capture a member of the population by randomly selecting one turtle. Set it aside.
4) Repeat step 3 nine times. Record the total number of turtles you captured.
5) Examine each turtle to see whether it has a mark. Count the number of recaptured (marked turtles). Record this number in your data table.
6) Count the actual number of turtles in your pond. (marked and unmarked)

Analyze and Conclude using the graphing calculator:

1) Turn the calculator on. Words written in these instruction in bold italics are keys you are to press.
2) Press ***Stat*** then ***enter***
3) Your screen should look like this:



4) In the column label L1 enter your year values of 1,2,3,4 so that the first column looks like this:



a. Use the arrows on the calculator to move the column labeled L2 enter your data by following the steps below. You will enter this formula for each of the years in the study. Use the equation to enter your data.

Total population= $\dfrac{\textbf{Number marked x total number captured}}{\textbf{Number recaptured (with marks)}}$

b. To enter this formula into your calculator type it as:
Number marked ***x*** total number captured ÷ Number recaptured (with marks)

Sample: 32 x 28 ÷ 15 = 59.7 or 60 turtles in the pond

Enter the numbers for your calculations in the spaces below:

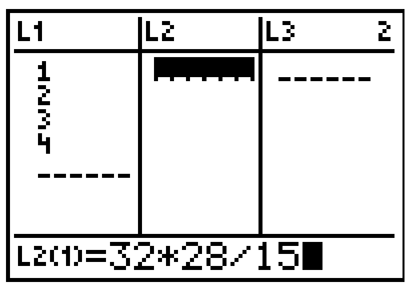
Year 1 __32___ x ___28___/ ___15______= total population

Year 2 ________ x _________/ ____________= total population

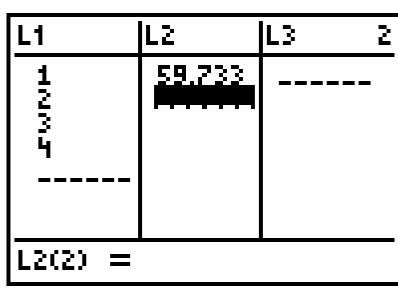
Year 3 ________ x _________/ ____________= total population

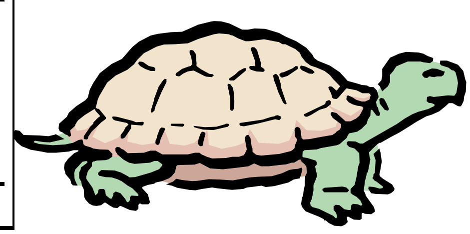
Year 4 ________ x _________/ ____________= total population

5) Your screen should look like this:



When you press ***enter*** it will look like this:





6) Continue entering your data in the formula until you have total population for each year in column L2.

7) Enter the total population numbers into your data chart on your lab paper.

8) With your partner come up with two ideas why the turtle population could be changing.

1) ____

____

____

2) ____

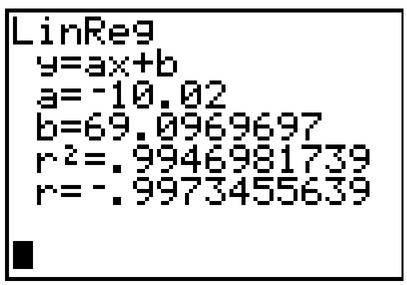
____

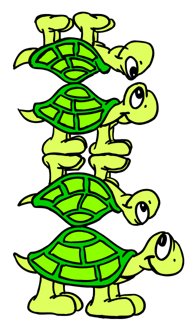
9) Was your population estimation close to the actual number of turtle in the pond?

____

To graph your results follow the following steps:

a. Press the grey ***Graph*** key on the calculator.
b. Press the ***zoom*** key; followed by the number ***9***
c. Press the ***stat*** key; then the ***right arrow*** key; then the number ***4***
d. Press ***2nd***; then the number ***1***; press the coma key "***,***" then ***2nd***; then the number ***2***; then the coma key "***,***"
e. Press the ***vars*** key; then the ***right arrow*** key; then press ***enter***; press ***enter*** again
f. Press ***enter*** one more time and your screen should look like this



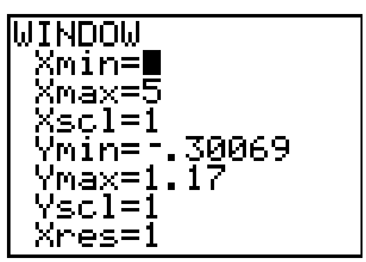


g. The last step is to press ***graph*** again.

h. You should now see a line which goes through each of your data points

10) In order to see a graph which is better scaled for our data follow these steps.

i. Press ***Window***
j. For X min= enter the minimum value for the number of years we studied. Your screen should look like this:



k. Enter the maximum number of years in Xmax=
l. Enter the lowest population number in Ymin=
m. Enter the highest population number in Ymax=
n. Press ***Graph***

10) Use the graph on the view screen to predict the turtle population in year 5.

____

why?____

____

____

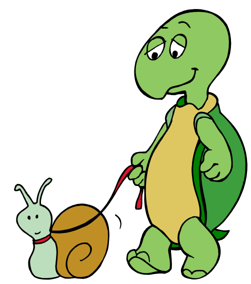
____

Data Table:

Year of study	Number of turtles marked	Number of turtles recaptured	Number of recaptured turtles which are marked	Total population
1	32	28	15	
2	25	21	11	
3	23	19	11	
4	15			

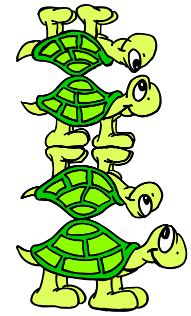
To end this lab :

1. Press ***2***



Target	Acceptable	Unacceptable
Students follow procedures correctly and work independantly	Students read directions and complete lab with few assists from the teacher	Students need to be instructed many times as to what the directions are
Science Concept thoroughly addressed. Described (*written*) in rich detail.	Complete sentences are used in the answer and then answer clearly shows student thinking. Answers are logical.	Incomplete sentences. Ideas are unfinished. Answers to not make sense.
Graphs are neat, accurate and based on data from the model.	Data table is neatly written and is completely filled in. Correct graph was obtained on the calculator	Data table is illegible. Data table is incomplete. Correct graph was not obtained.
Student is very capable of *describing the model to a small group of peers* and is able to respond meaningfully to questions about the model.	Student understands how population size can be estimated.	Student does not understand how population size can be estimated.
Defines exactly how the modeling software "helped" solve the problem.	Student gains understanding of how graphing a problem can be helpful in determining correct predictions	Student does not make the connections between a mathematical prediction and guesswork
Student made good use of time	Student was actively working on the task in an efficient way	Student was often off task and needed to be focused repeatedly
Student worked well with their partner	Student shared ideas and materials in a pleasant and polite manner. Student helped others. Student kept off task behavior to a minimum. Student participated well.	Student did not share ideas and materials. Student did not help others when their own work was finished. Student pulled others off task. Student did not participate well.

Teacher page for lesson- Turning Turtle



Materials:

A box or paper bag to represent a pond for each two students
Model paper turtle population (one population for each two students
Graphing calculators (one teacher and one TI-84 for every two students)
view screen
Student Lab

note: Turtle populations can be represented by any small object in which you can mark one side of the object. Ie: you can use pennies, buttons, beads, foam pieces or what ever is close at hand. The best turtles are those that have markings which are not easily seen when the turtles are being selected.

Note to teacher: For this lab you need to have aprox. 30 turtles for each group

Assessment of prior knowledge:

Ask students how they could figure out how many turtles live in a pond. (5 – 7 minutes)

Lesson start: (5-10 minutes)

Pose the prior knowledge question and then tell the students that they are now the "research scientist" chosen to solve a perplexing turtle problem.

Teacher role: Discuss the role of mathematical calculations in solving science questions. Chose partners for the lab. Hand out student labs and read over the initial procedures as to how they will sample their "ponds".

Phase one: (10 minutes)

Hand out "ponds" and turtles. Be sure that the students understand that they are to randomly select turtles. Have students follow procedure steps 1-5. Students who are finished early should be given a piece of graph paper in order to create the type of graph they think will best display their data.

Hint: suggest that students look at the ceiling when reaching in to grab their turtles instead of looking in the pond. (don't worry they aren't snapping turtles)

Teacher role: check data tables to ensure that they are completed correctly

Phase two: (15 minutes)

When all students are finished hand out the graphing calculators. Collect turtles and ponds. Designate one student as the button pusher and one as the direction reader.

Have the students follow steps listed for entering their data. (10 minutes)

Note:As the lab progresses circulate the room to assess how students are following directions. If students finish early you can designate them as being "teacher clones" and have them circulate the room helping other partners with their data entry.

Teacher role: discuss why population could be following the pattern seen.

Phase three: (15 minutes)

Check to see that all partners have entered their data correctly. Examine any graphing ideas the students may have. Why would a scatter plot be better than a bar graph? What would be the best origin points for the graph? What should our minimum and maximum values be?

Teacher role: discuss predictions and why students think the predictions are correct.

Note: student predictions may not follow the trend seen in their graph. If student reasoning is sound it should be accepted. Ie: the turtle population will level off because it has reached carrying capacity; it will increase because it was a disease that was reducing the population and now only those resistant to the disease are left.

Phase four: (15 minutes)

Have students follow the steps for graphing the problem. Have the partners change roles (reader and button pusher). If student encounter problems with their graphing have them start over again at the beginning of the graphing section.

Note:As the lab progresses circulate the room to assess how students are following directions. If students finish early choose different students to be "teacher clones" and have them circulate the room helping other partners with their data entry.

Teacher role: On the view screen demonstrate different types of graphs that could have been created. Discuss with students which graph type might be the best to work with the data collected.

Phase five: (5 minutes)

Have students reset the calculators for the next class.

Teacher role: collect calculators

Assessment of the lesson will be gaged by questions posed throughout the lab; and teacher observations of student progress. Stress needs to be placed on the students ability to read and follow directions carefully. Strategies such as crossing out the number of the step as it is completed and double checking work along the way need to be stressed.

The lab itself can be evaluated for the validity of the ideas that were presented.

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Turtle model (actual size):